HALO OF JANUARY 10, 1918, AT BOULDER, COLO.

In Science for February 15, 1918, pages 170–171, O. C. Lester reports the observation, at Boulder, Colo., of brilliant halo phenomena on January 10.

The phenomena included the 22°-halo, with a portion of its parhelic circle and its 22°-parhelia. The halo was bright, showed red inside and faint blue outside, and was accompanied by the upper fragment of the circumscribing halo ("ox-yoke curve").

The 46°-halo developed also, complete to the horizon (colors red inside and blue outside), with a strongly colored upper tangent arc.

With increasing altitude the parhelic circle became almost complete, developed the paranthelia of 120°; and the parhelia of 22° became dazzling, considerably elongated vertically, and colored orange red on the sides away from the sun.

At 11 a. m. the 22°-halo appeared as a complete circle with the inferior summit showing brightly; the 46°-halo and its upper tangent reached almost to the zenith.

Measurements were made with an improvised transit. The air was quiet and filled with falling ice crystals [needles?]. Temperature, −3° to −4° (F.?).

DIFFRACTION OF LIGHT IN THE FORMATION OF HALOES.[1]

By S. W. VISSER.

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Haloes are commonly considered to be formed by the refraction of the sun's rays through ice crystals, and this explanation was adopted by J. M. Pernter among others. This theory does not account for all the features of haloes in an entirely satisfactory manner. In the present paper the author suggests a modification of the usual theory by taking into account the effects of diffraction.

The ordinary theory is discussed in detail. It is found that it leads to a maximum intensity of illumination in the case of the 22°-halo at an angle of 22½° from the sun, whereas observation shows this angle to be actually a little less than 22°. It is also difficult to explain by means of the simple refraction theory, the great variety of colors which are sometimes seen. When diffraction is taken into account, the size of the ice crystals becomes a matter of importance. In the calculations here made these are assumed to be homogeneous in size, a condition specially favorable to the development of color. An application of the diffraction theory to a special case gives very satisfactory agreement between the theoretical distribution of the colors and that actually observed. The side of the hexagonal ice crystal is calculated, in this case, to be 0.279 mm. It is found that very small crystals will lead to a halo which has a red inner edge and in which no other color is seen but white, while larger crystals produce more distinct coloring. It is urged that accurate observations of the coloring of halos should be made, as without this information reports are of little or no value.—*J. S. Di*[*nes*].

[1] Proc., K. Akad, Amsterdam, 1917, 19: 1174–1196.

HORIZONTAL OSCILLATION OF THE FREE ATMOSPHERE UP TO 10 KM., AT BATAVIA.[1]

By W. VAN BEMMELEN and J. BOEREMA.

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The data used for the determination of the diurnal variation of wind velocity at different heights is taken from pilot-balloon ascents made both by day and by night during the seven months May to November at Batavia when the prevailing winds are easterly. A variation comprising 24-hour and 12-hour terms has been assumed and the values of the harmonic constants were determined by the method of least squares, from the difference in velocity found between pairs of consecutive ascents. By this means it is hoped that nonperiodic variations have been largely eliminated. The east-west and north-south components have been dealt with separately. The general coast line runs east-west at Batavia and, as would be expected, the influence of land- and sea-breezes is distinctly felt in the north-south component at the lower levels. The mixing of upper and lower wind currents by convection (Espy-Köppen effect) also makes its influence felt. It is found that these influences may be neglected above 4 km. and the present discussion is mainly confined to the levels above this height, while the lower layers will be dealt with separately in a later paper.

A series of observations is at present in progress from a small island in the Java Sea where the conditions approximate more closely to those over the open ocean. The results from the present series for levels above 4 km. show (1) that the amplitude of the 24-hour variation is small for both north and east components; (2) that the 12-hour term of the north-south component is also small, though more definite than the 24-hour term; and (3) that the amplitude for the 12-hour term of the east-west component is much larger and increases from about 28 cm./sec. at the surface to 54 cm./sec. at 4 km. It then decreases to 22 cm./sec. at 7 km. and increases again to 38 cm./sec. at 10 km. The phase angle diminishes up to 4 km. and above this remains almost constant at 150° to 6 km. The observations are not at present numerous enough to allow of any very accurate determination of the changes of phase above this height. In the lower layers the variations seem to be in agreement with the theoretical results which Gold has deduced from the pressure variations.—*J. S. Di*[*nes*].

EARLY USE OF KITES IN MILITARY OPERATIONS.

In an interesting paper, "Chinese Contributions to Meteorology," Mr. Co-Ching Chu states [2] that the use of kites for military purposes was devised in China even before the time of Archytas of Tarentum [about 400–350 B. C.],[3] who built a wooden dove. Moti (500–400 B. C.) mentions a genius Kung-Shu Pan who spent three years building a bird of wood and bamboo, which, when finished, flew in the air for three days and three nights without apparent tendency to fall and was used to attack the capital of Sung in the interest of the then hostile State of Tsou.—C. A., jr.

[1] Proc., K. Akad. Amsterdam, 1917, 20: 119–135.
[2] Geographical Review, New York, Feb., 1918, 5: 136–137.
[3] The dates for Archytas of Tarentum are from Johnson's New Universal Cyclopedia, New York, 1884.—C. A., jr.